ThinkLite Air®

Case Study

Protecting GPU Deployments via Continuous Air Quality Monitoring

Importance of IAQ Monitoring in HPC Centers

High-performance computing centers deploy multi-million dollar GPU infrastructure for AI and advanced workloads. Despite high standards, many facilities rely on infrequent particle testing that fails to capture sudden contamination spikes from maintenance, construction, or external air intrusion. For GPU-intensive environments, this creates a risk of unrecorded events between annual checks. Furthermore, settled particles on subfloors and equipment can be reintroduced into the airflow, necessitating that continuous monitoring be paired with physical preventive cleaning.

The Challenge

An AI/HPC operator with a 30,000 sq. ft. data hall faced GPU failure rates near 20%. Manufacturers attributed these to airborne contamination, but because the operator lacked continuous historical air quality records, warranty claims were denied. This highlighted the need for constant visibility and the removal of settled contaminants.

Why Continuous IAQ Monitoring Matters in HPC Data Centers

High-performance computing data centers are deploying increasingly expensive GPU infrastructure to support artificial intelligence, machine learning, cloud computing, and advanced enterprise workloads. These GPU environments require significant capital investment, often reaching millions of dollars in equipment within a single data hall.

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While most data centers have strong mechanical, electrical, and operational standards, many still rely on annual airborne particle testing or periodic spot checks to confirm that critical spaces remain within acceptable cleanliness thresholds. The challenge is that contamination events do not wait for an annual inspection. Airborne particulate levels can spike due to construction activity, maintenance work, filter issues, outside air intrusion, airflow disruption, personnel activity, or localized contamination events.

For HPC and GPU-intensive environments, this creates a significant risk: a facility may pass an annual particle count but still experience unrecorded contamination events between testing periods.

Just as important, airborne contamination is only part of the issue. Particles that settle on subfloors, ceiling plenums, floor surfaces, cabinets, racks, cable trays, and equipment exteriors can be disturbed and reintroduced into the airflow over time. This is why continuous air monitoring should be paired with a physical preventive maintenance cleaning program.

The Challenge

A leading AI/HPC data center operator deployed expensive GPU infrastructure inside a 30,000 sq. ft. data hall. After deployment, the facility began experiencing unusually high GPU chip failure rates, reportedly approaching 20%.

The GPU manufacturer inspected the failed chips and determined that airborne contamination was a contributing cause of the failures. Because the facility could not provide continuous historical evidence showing that the data hall had maintained required indoor air quality conditions, warranty claims were denied.

The incident exposed a major operational gap: periodic particle counts and spot checks could not prove what air quality conditions were like throughout the year, during off-hours, during maintenance activity, or during short-term contamination events. It also highlighted the need to remove settled contamination from the physical environment before it could become airborne again.

The Business Risk

For HPC data centers, poor visibility into airborne contamination and insufficient removal of settled particles can create several costly consequences:

- Premature GPU, server, & electronic component failures
- Reduced equipment lifecycle & reliability
- Increased maintenance & replacement costs

- Warranty claim disputes due to lack of historical IAQ records
- Reintroduction of settled contamination into airflow pathways
- Operational risk during maintenance, construction, & tenant activity
- Inability to document ongoing compliance with cleanliness expectations

The Complete Solution

The data center operator moved from periodic testing to a more complete indoor air quality management program combining continuous monitoring, historical analytics, autonomous air purification, and scheduled critical cleaning.

1. Continuous Indoor Air Quality Monitoring

The facility deployed the ThinkLite Air system to provide 24/7 visibility into airborne conditions across designated critical spaces.

The program included five ThinkLite Flair indoor air quality monitors across the 30,000 sq. ft. data hall. Each Flair monitor provides effective coverage of approximately 5,000 sq. ft. and continuously detects, analyzes, and reports indoor air quality metrics.

This allowed the facility team to monitor air quality conditions in real time rather than relying solely on annual particle counts or periodic spot checks.

2. Outdoor Air Intake Monitoring

The facility also installed two Flair outdoor air in-duct units to monitor the quality of outside air entering the data hall through supply ducts.

This provided visibility into potential contamination entering the facility through outside air systems and helped the team better understand whether particle spikes were generated internally or introduced from external sources.

3. Historical Trending and Dashboard Visibility

Air quality data was displayed in ThinkLite's Airlytics analytics dashboard. This gave the operator access to ongoing visibility, historical trending, and actionable reporting.

The dashboard helped the facility team:

- Identify particle spikes & track trends over time
- Document air quality conditions & support compliance efforts
- Provide historical data for warranty discussions

4. Autonomous Air Purification Response

Because the ThinkLite system can integrate with building management systems, the facility was able to connect air monitoring with air treatment response.

When contamination levels increased in specific areas, autonomous air purification could be activated using ThinkLite ICON M air purifiers.

The ICON M is a portable, freestanding air purification unit designed for large commercial environments. It treats up to 5,000 sq. ft., provides five air exchanges per hour, and only requires approximately 2.5 sq. ft. of floor space.

This allowed the facility to respond quickly to localized contamination events rather than waiting for the next scheduled inspection or cleaning.

5. Preventive Maintenance Critical Cleaning

Continuous monitoring helps detect airborne contamination, but physical cleaning is still required to remove settled particles from the data center environment.

ProSource recommends a preventive maintenance critical cleaning program at least annually, or more frequently depending on facility conditions, construction activity, equipment density, and monitoring data.

A complete PM critical cleaning program may include:

- Subfloor & ceiling plenum cleaning
- Raised & non-raised floor surface cleaning
- Equipment, cabinet, & rack exterior cleaning
- Cable tray & overhead raceway cleaning
- Post-construction or post-installation cleaning as needed

This cleaning removes settled contamination before it can be disturbed and pulled back into the airflow. It also helps maintain cleaner environmental conditions around sensitive GPU, server, storage, and network equipment.

Why Monitoring and Cleaning Work Better Together

Continuous monitoring and critical cleaning serve different but complementary purposes. Monitoring provides visibility. Cleaning provides physical removal.

A continuous IAQ system can detect particle spikes, identify trends, and document conditions over time. Critical cleaning removes accumulated contamination from surfaces, subfloors, plenums, and equipment areas that can contribute to future airborne particle events.

Together, they create a stronger environmental control program for HPC data centers.

Continuous Monitoring Helps Answer:

- Are airborne particulate levels changing throughout the year?
- Are particle spikes occurring during maintenance or construction activity?
- Are outside air systems contributing to contamination?
- Can the facility document air quality conditions historically?
- When should additional cleaning or purification be triggered?

Critical Cleaning Helps Address:

- What settled contamination already exists in the space?
- What particles are collecting under the raised floor or above the ceiling?
- What contamination may be disturbed during airflow changes or maintenance?
- Are floor surfaces, equipment, & overhead areas contributing to particle load?
- How can the facility reduce the source of future airborne contamination?

The Outcome

By implementing continuous monitoring, analytics, autonomous purification, and preventive maintenance cleaning, the data center gained a more proactive way to manage air quality in its GPU environment.

The program helped the operator:

- Monitor airborne conditions 24/7 & Identify contamination spikes in real time
- Create historical IAQ records for compliance & warranty support
- Respond quickly with localized air purification
- Remove settled contamination from critical spaces
- Better protect high-value GPU infrastructure & support longer equipment lifecycle
- Move from reactive testing to proactive environmental management

Bundled Service Plan

ThinkLite Air monitoring, Airlytics analytics, ICON M purification equipment, and ProSource critical cleaning services can be combined into a complete monthly managed service plan.

Through this bundled model, HPC data center operators can receive:

- Air quality monitoring equipment, installation & commissioning
- Dashboard access and historical reporting
- Autonomous purification equipment
- Periodic preventive maintenance critical cleaning
- Documentation to support compliance and warranty discussions

This creates a complete air quality assurance program that combines data, response, and physical contamination removal.

Conclusion

For AI, HPC, and GPU-intensive data centers, indoor air quality is no longer just a facility maintenance issue. It is an equipment protection, uptime, compliance, and warranty validation issue.

Annual air particle counts provide a useful snapshot, but they do not provide continuous proof of conditions. Continuous monitoring provides visibility and historical documentation. Autonomous purification provides an active response. Critical cleaning removes settled contamination before it can become airborne again.

For operators investing millions of dollars in GPU infrastructure, a complete air quality monitoring and critical cleaning program can help extend equipment lifecycle, reduce failure risk, support warranty claims, and protect mission-critical performance.

Ensuring Data Centers Stay Clean and Compliant

P (888) 247-0986 | **E** info@team-prosource.com
www.team-prosource.com